

The Mesoscale Model Evaluation Testbed (MMET): Assisting with the Transition of Promising NWP Techniques from Research to Operations

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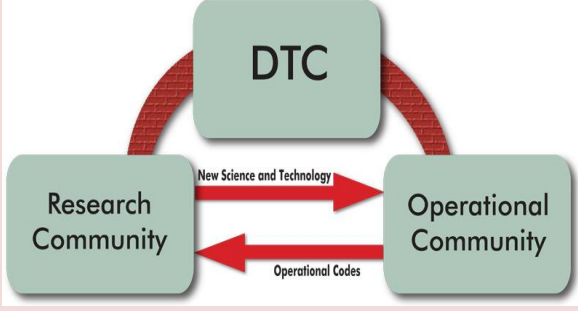
Motivation: A *testing protocol detailing* the procedures necessary to *advance* new innovations *efficiently* and *effectively* through the *research to operations (R2O) process* was defined by the Developmental Testbed Center (DTC) in collaboration with its operational partners. As part of this process, the *Mesoscale Model Evaluation Testbed (MMET)* was established to assist the research community in demonstrating the merits of a new technique by *providing datasets to utilize* for testing in a common framework.

DTC Mission

The *fundamental purpose of the DTC* is to facilitate the interaction & transition of NWP technology between research & operations.

DTC facilitates:

- **O2R** transition by making the operational NWP systems available to the research community
- **R2O** transition by performing extensive testing & evaluation of new NWP innovations in a functionally similar operational environment
- **Interaction** between research & operational NWP communities through the organization of community workshops/meetings & hosting a DTC Visitor Program



Three Stage Testing Protocol Process

Stage I: Proving ground for research community

- **Code development**
 - Encourage contribution of new technique into WRF repository
- **Initial stage of testing**
 - Utilize multiple cases within MMET to demonstrate versatility of technique
 - Communicate results to DTC
 - Nominate for Stage II testing

Stage II: Comprehensive T&E performed by the DTC

- Conduct comprehensive testing for a broad range of weather regimes within a **functionally similar operational environment**
- Evaluate based on **extensive objective verification statistics**, including traditional metrics and new verification techniques

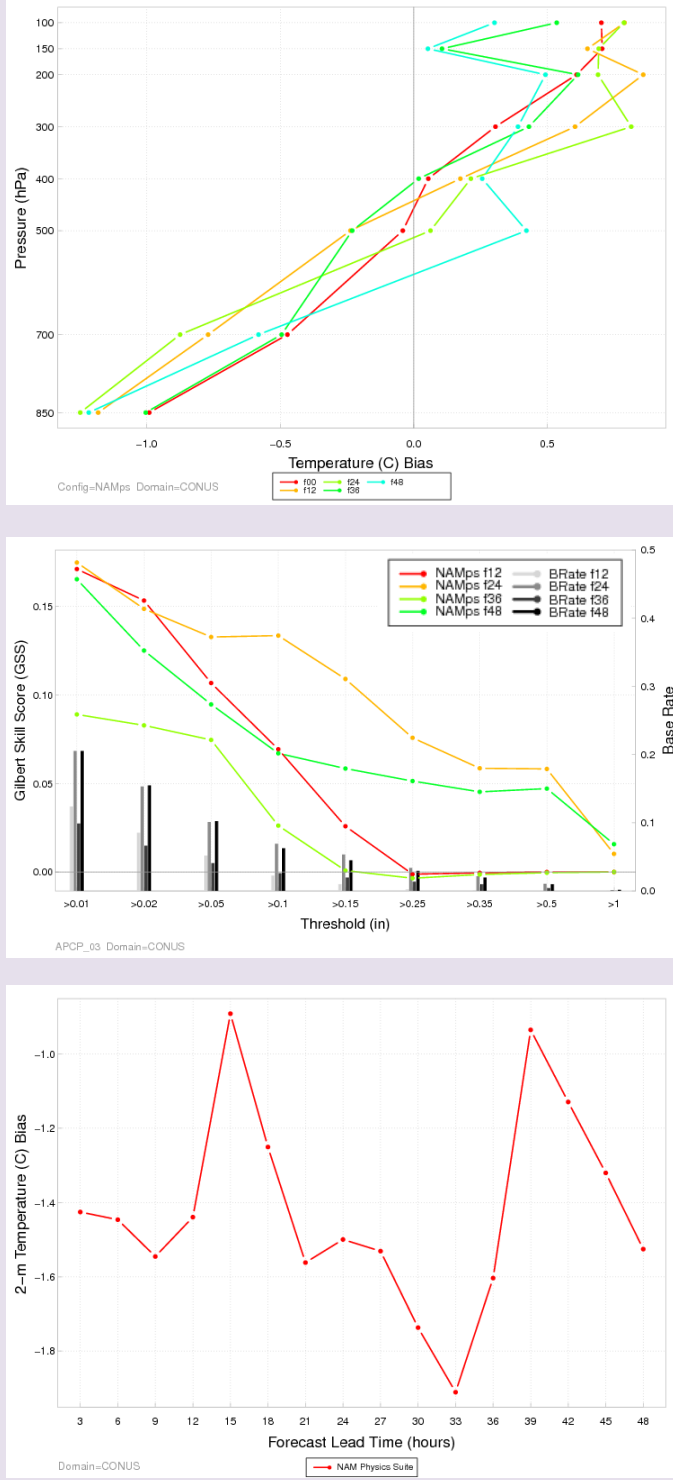
Stage III: Pre-implementation testing at operational centers

- **Decision to proceed made by the operational centers**
 - Based on factors such as forecast performance & computational resources
- Testing specifics depend on target production configuration
 - May include data assimilation and initial condition diversity testing for ensemble members

MMET & DTC Baseline Testing

- MMET is a mechanism to assist the research community with the initial stage of testing to *efficiently demonstrate the merits* of a new technique
- The DTC provides the user community with:
 - **Model input** and **observational datasets** for testing
 - **Baseline results** established by the DTC for select Operational Configurations (OCs), allowing for direct comparisons of new innovations and OCs
 - **Scripts** to assist with post-processing, graphics generation, and model evaluation
- MMET is hosted by the DTC, with data served through **Repository for Archiving, Managing and Accessing Diverse Data (RAMADDA)**
- For further information on the testing protocol, case descriptions, and access to RAMADDA: <http://www.dtcenter.org/eval/mmet>

Example of baseline results
20110522 00 UTC init
(Joplin, MO tornado)



MMET Cases	Meteorological Scenario
20090228	Mid-Atlantic snow storm where NAM model produced high QPF shifted too far north
20090311	High dew point predictions by NAM over the upper mid-west and in areas of snow
20091007	HIRESW runs underperformed compared to coarser NAM model
20091217	" Snowpocalypse '09 ": NAM produced high QPF over mid-Atlantic, lack of cessation of precipitation associated with decreasing cloud top over eastern North Carolina
20100428-0504	Historic Tennessee flooding associated w/ an atmospheric river
20110404	Record breaking severe report day
20110518-26	Extended period of severe weather outbreak covering much of the mid-west and into the eastern states later in the period
20111128	Cutoff low over SW US; NAM had difficulties throughout the winter of breaking down cutoff lows and progressing them eastward
20120203-05	Snow storm over Colorado, Nebraska, etc.; NAM predicted too little precipitation in the warm sector and too much snow north of front (persistent bias)

Moving Forward with MMET

- Run case suite with **WRF-ARW (v3.5) & NMMB**
- Continue to **add more cases**, including routine, high-impact and field campaign cases (e.g., Hurricane Sandy)
- Allow for **user community to nominate cases** of interest via web submission form: http://www.dtcenter.org/eval/mmet/cases/form_submission.php

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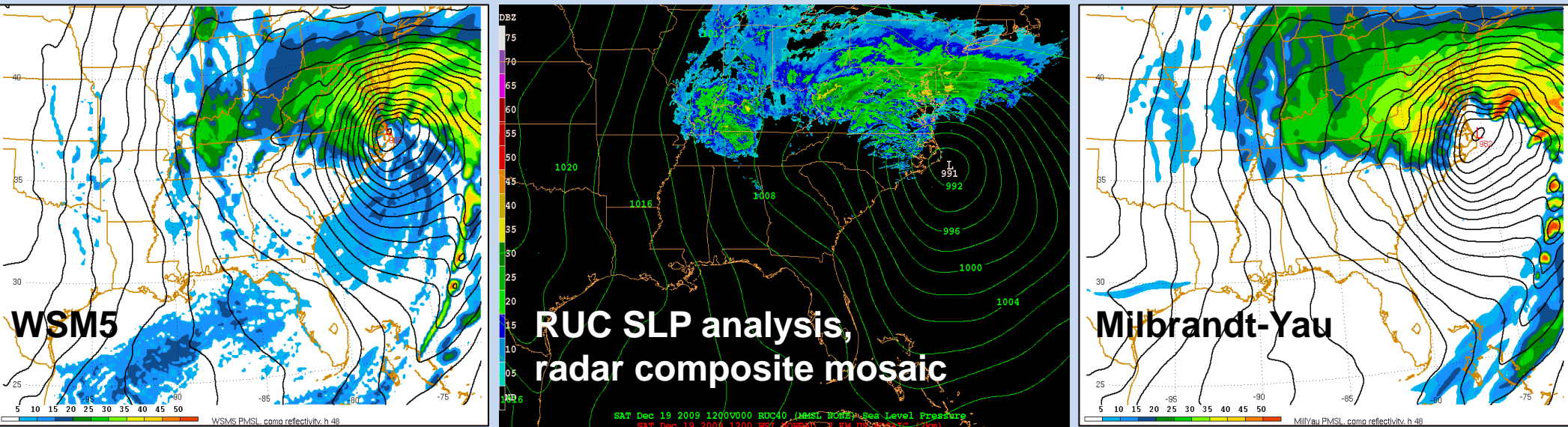
User Case #1 – 20091217 12 UTC “Snowpocalypse”

Submitted by Gary Lackmann

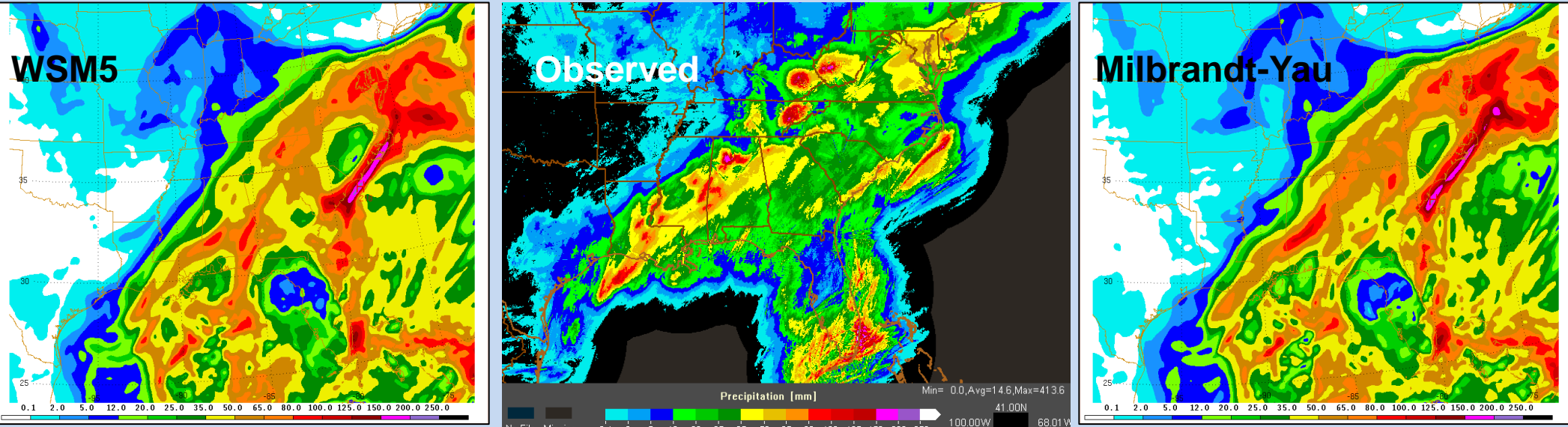
Case Details

Forecasts: WRF v3.4 ARW baseline configuration namelist from DTC
WRF v3.4 ARW namelist w/ **mp_physics=9** (Milbrandt-Yau)
CONUS domain at **15km resolution**

Model Initialization: Utilized **IC** and **BC** files provided by DTC
48-h WRF Forecast



72-h Total Precip Accumulation



Case Summary

- Both forecasts captured main features
 - Axis of precipitation over coastal Carolinas and VA
 - Precipitation minimum over FL
- Significant over-prediction over NC, SC, and VA and issues with cessation of precipitation

User Case #2 – 20100428-20100504 Flooding in TN

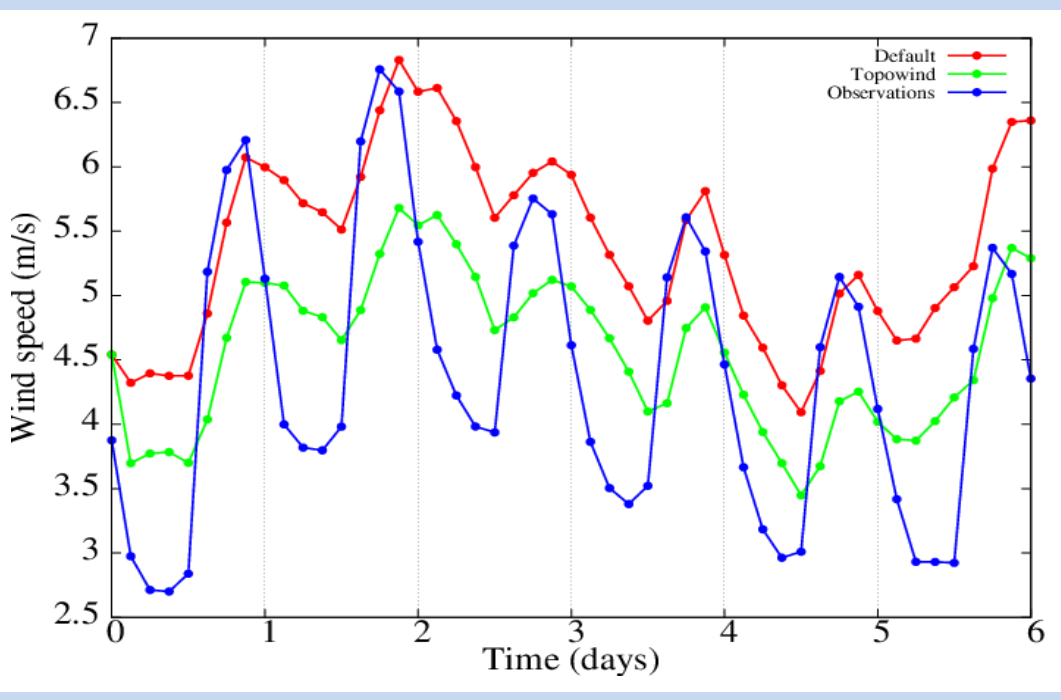
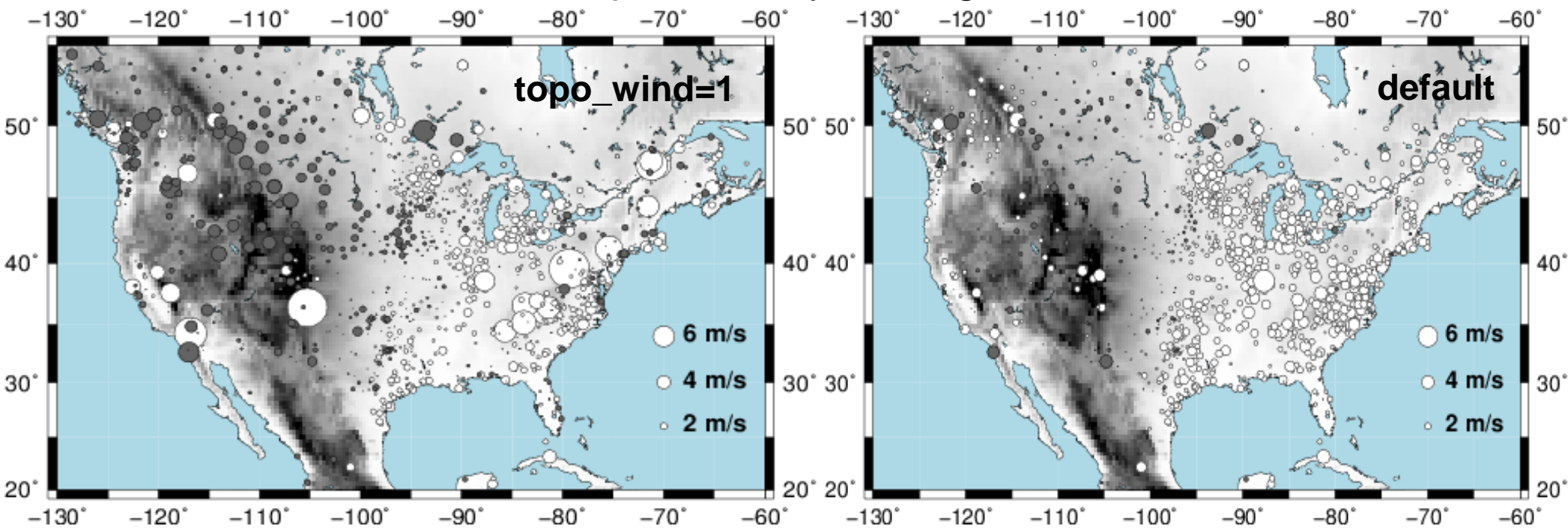
Submitted by Pedro Jimenez & Jimmy Dudhia

Case Details

Forecasts: WRF v3.4 ARW baseline configuration namelist from DTC
WRF v3.4 ARW namelist w/ **topo_wind=1** activated
CONUS domain at **15km resolution**

Model Initialization: Utilized **IC** and **BC** files provided by DTC
Verification: Utilized **observation** files provided by DTC

Wind Speed 6-day Average Error



Case Summary

- Overall 6-day domain average with **topo_wind=1** **smaller than default**
- Reduces diurnal mean bias but does not capture full diurnal amplitude
- Future work to **reduce convective mixing and vertical transport of momentum**